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THE TOXICITY OF LAEVULOSE CYANHYDRIN, TOGETHER WITH GENERAL OBSERVATIONS ON CYANIDE POISONING

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A.—The Toxicity of Laevulose Cyanhydrin

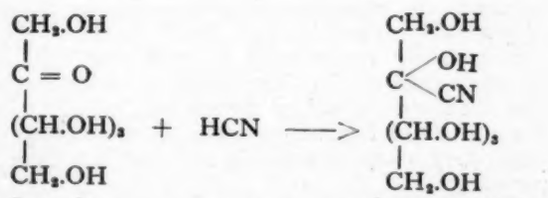
Introduction

Hydrogen cyanide gas has for many years been employed as a fumigant and its use in the fumigation of ships, for example, is becoming widespread. Although in low concentrations it is apparently without permanent effect on bacteria and higher fungi, it is very efficient for the destruction of vermin and arthropod pests and in this capacity is of value, when skilfully applied, for treating large consignments of foodstuffs. The risks to the consumer of fumigated foods have been considered by various investigators including Monier-Williams (1930) who has indicated the factors influencing retention of HCN by foodstuffs and the conditions under which the fumigation process may be safely applied. Monier-Williams also suggested that certain foods should receive particular attention, especially those containing laevulose, such as dried fruits, which may retain HCN owing to the formation of laevulose cyanhydrin.

More detailed studies have subsequently been made at the Biological Field Station, Slough, and much is now known concerning the conditions of retention of HCN, both by physical absorption and by combination as laevulose cyanhydrin. The account of this work awaits publication. Little, however, appeared to be known concerning the actual toxicity of laevulose cyanhydrin and the present study was therefore undertaken in the biochemical laboratory of the Veterinary Laboratory of the Ministry of Agriculture at Weybridge, by arrangement between Professor J. W. Munro and Dr. W. H. Andrews. Sufficient cyanhydrin for the purpose was prepared by Mr. E. E. Turtle, of the Biological Field Station, who also supplied information in regard to the properties of the substance and the extent of its occurrence in fumigated fruits, the animal experiments being carried out in consultation with Dr. H. H. Green.

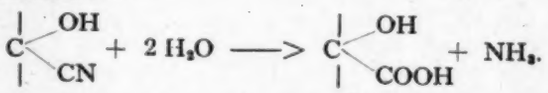
NATURE OF THE COMPOUND

The reaction of hydrocyanic acid with laevulose is that of simple addition at the ketone grouping :—



Laevulose *Laevulose cyanhydrin*

The compound thus contains 27/207 or approximately 13 per cent. by weight of HCN. In aqueous solution partial dissociation occurs with reversal of the equation and re-formation of the toxic hydrocyanic acid, but in the non-dissociated state treatment with alkali can result in hydrolysis of the cyanhydrin grouping to the corresponding non-toxic hydroxy-acid and ammonia :—



The actual toxicity of laevulose cyanhydrin should, therefore, depend upon the extent to which the two reactions, dissociation and hydrolysis, occur within the alimentary tract of the animal, and should be readily determined by comparison of its toxic effects with those of a simple cyanide such as KCN.

Experimental

The first step was to assess the M.L.D. of the compound for experimental animals. For this purpose, preliminary dosage was based upon the theoretical HCN equivalent and descending quantities of 0·50, 0·17, 0·10 and 0·05 g., dissolved in 10 ml. of water, were administered to four rabbits of similar weight, about 2 kg., by stomach tube, a further 10 ml. of water being used to rinse out the syringe and tube and to promote rapid passage into the duodenum.

With the two higher doses, the rabbits showed immediate increased respiration and died within 13 minutes with typical symptoms of cyanide poisoning. The animals sank to the ground, incoordination and pronounced respiratory distress appeared within five minutes, and the corneal reflex disappeared within nine minutes, followed a few minutes later by complete cessation of respiration and heart beat; in one case a " cry " was noted. With the 0·10 g. dose, distinct

respiratory distress and incoordination appeared in about six minutes and continued for about an hour. Even after two hours, respiration was still accelerated but symptoms gradually passed off and next morning the rabbit was eating normally and apparently none the worse for the dose. The 0·05 g. dose did not produce any symptoms at all.

These observations suggested that the M.L.D. of the cyanhydrin, given in solution by stomach tube, lay around 0·10 g. This was confirmed by dosing another rabbit with the same quantity. On this occasion the animal showed more pronounced respiratory distress and died within 20 minutes with typical sequence of symptoms. Individual rabbits would doubtless vary considerably in reaction to more closely graded dosages, but to determine the range of susceptibility would have required a large number of animals and for provisional purposes 0·10 g. of laevulose cyanhydrin was accepted as an average lethal dose.

For comparative purposes two rabbits were dosed in exactly the same way with equimolecular quantities of potassium cyanide, *i.e.*, 0·015 g. and 0·031 g. corresponding respectively to 0·05 and 0·10 g. of laevulose cyanhydrin. The rabbit receiving the larger dose died with typical symptoms within half an hour; the one receiving the smaller dose showed slight respiratory symptoms within an hour but these soon passed off.

Taking titration to silver nitrate as a measure of the total cyanogen radicle present, the sample of laevulose cyanhydrin, at the time of use, contained 9·1 per cent. HCN or approximately 70 per cent. of the theoretical, as against 93 per cent. of the theoretical for the sample of KCN. Recalculated on this basis, the M.L.D. of 0·10 g. cyanhydrin provided 9·1 mg. HCN, as compared with 11·8 mg. for the fatal dose of 0·031 g. KCN, while the 0·015 g. dose of KCN, which produced slight evanescent symptoms, corresponded to 5·7 mg. HCN. The 0·05 g. dose of laevulose cyanhydrin which failed to produce noticeable effects corresponded to 4·5 mg. HCN. Allowing for biological variation in different rabbits, it is apparent that there is not much difference in toxicity between laevulose cyanhydrin and potassium cyanide when compared on the basis of HCN equivalent.

Different species of mammals are known to vary in their susceptibility to HCN, and during the war of 1914-18 a comprehensive investigation of the biological effects of HCN gas, undertaken at the R.E. Experimental Station, Porton, indicated that dogs are particularly susceptible (cf. Stock and Monier-Williams, 1923); that the dog is more susceptible than man is suggested by the observation of Barcroft (1931) describing the behaviour of a man and a dog placed together in a chamber containing a probable concentration of 1/2,000 of HCN gas.

In the present experiments, two dogs were available and to one of these, an aged greyhound bitch weighing 23 kg., doses of 0·50, 1·00 and 1·50 g. of laevulose cyanhydrin were given on successive days, each time in 50 g. of minced beef voluntarily consumed. The animal was exercised for a few minutes after eager consumption of the meat and on the first two days showed no symptoms whatever, apart from slightly exaggerated respiratory movements which could be attributed to age and lack of condition. Following the 1·50 g. dose on the third day, however, symptoms of poisoning appeared within about an hour of administration. Respirations became deep and later gasping, with prostration, occasional retraction of the head with accompanying tonic movements of the fore legs and drawing up of the hind legs, and dilatation of the pupils. Death ensued two and a quarter hours after dosing. There was no evidence of vomiting, so that the dose can be assumed to have been wholly retained. As far as can be judged from one animal, the toxicity of laevulose cyanhydrin is of the same high order as for the rabbit and the magnitude of the dose suggests approximate equivalence with potassium cyanide on the basis of HCN content. Voluntary consumption of the cyanhydrin in a small quantity of minced meat in place of administration in aqueous solution by stomach tube does not seem to have materially affected the result, although it is probable that a smaller dose than 1·50 g. per 23 kg. body weight (equivalent to about 6 mg. HCN per kg.) would have been effective by the latter route.

Monier-Williams (1930) in discussing the possible toxicity of the cyanhydrins of the sugars, suggested that these, like cyanogenetic glucosides in absence of an associated hydrolytic enzyme, might be non-toxic, and that the toxicity of fumigated dried fruit would depend upon whether the conditions of the alimentary tract were such as to favour dissociation into sugar and HCN or hydrolysis to hydroxy-acid and ammonia. From the experiments here described, it is apparent that at the dilutions encountered in the alimentary tract the degree of dissociation of laevulose cyanhydrin is so high that the compound must be considered to be almost as toxic as the simple cyanides. In this connection, it must be remembered that hydrolysis would be expected to occur only in the alkaline region of the small intestine, that the *p*H there is not really high, and that the time elapsing between reaching the duodenum and absorption into the blood stream is probably very short.

It was suggested by Mr. Turtle that the presence of a large excess of laevulose in relation to cyanhydrin, as found in fumigated fruits, might tend to depress dissociation. In dried sultanas, 40 per cent. of laevulose may be associated with about 0·1 per cent. of laevulose cyanhydrin, *i.e.*, the M.L.D. for the rabbit would be associated with 40 g. of laevulose. It was obviously impossible to test this point with precision, since 40 g. of laevulose is an impracticable dose for a rabbit, but an approximation to it was made by associating cyanhydrin and laevulose in the ratio of 1 : 20. A 2 kg. rabbit was given alternate doses of laevulose cyanhydrin plus laevulose, and laevulose cyanhydrin alone. On the first day 0·10 g. cyanhydrin plus 2·0 g. laevulose were administered by stomach tube in 10 c.c. of water; no symptoms were observed. On the following day, the same dose of cyanhydrin was given without the laevulose, again without symptoms. The experiment was then repeated with 0·15 g. cyanhydrin, with and without additional laevulose. Symptoms were identical in both cases, being pronounced for half an hour but not fatal. On the following day, however, a dose of 0·02 g., with laevulose, proved fatal. It may be noted that, although this rabbit was more resistant than usual, recovering from so high a dose as 0·15 g., the addition of 2 g. of laevulose did not protect against a further increment of 0·05 g. of the cyanhydrin. It also seems unlikely that still larger quantities of free laevulose would have any practical protective effect. Dilution in the alimentary

tract is considerable and even if dissociation were temporarily depressed, the laevulose cyanhydrin would presumably be absorbed as such from the small intestine along with the laevulose itself, and, once into high dilution in the blood stream, be free to exercise its fully dissociated effects.

Detoxication of Cyanhydrin in the Body

In discussing the question of toxicity of the cyanide radicle in any form, it must be remembered that the body possesses efficient mechanisms for excreting and detoxicating cyanides, and that the actual effects of any given quantity depend upon the *rate* of absorption into the blood stream in relation to the *rate* of elimination and detoxication.

In order to investigate this point, two experiments were carried out on rabbits and one on a dog. To the first rabbit, weighing 2 kg., three doses of 0·05 g. of laevulose cyanhydrin were administered at intervals of two and a half hours, *i.e.*, one and a half times the M.L.D. spread over five hours. The doses were given in 10 ml. water by stomach tube as before. On the basis of previous tests the full quantity as a single dose would have resulted in death, or at least in very pronounced symptoms, within half an hour. Apart from slight uneasiness after the second dose, probably attributable to the second insertion of the stomach tube, and not noted either at the first or third dosing, no untoward symptoms whatever were observed. The brief period of two and a half hours between dosings was apparently sufficient to dispose of half a " minimum lethal dose " without difficulty, by excretion and detoxication, so that no cumulative effect occurred.

To the second rabbit, also weighing 2 kg., a dose of 0·50 g. laevulose cyanhydrin, or 5 M.L.D., was offered for voluntary consumption, intimately mixed with 20 gm. of bran after a fasting period of 12 hours. The animal ate readily for about two minutes, probably consuming a few grammes (less than the equivalent of 1 M.L.D.) then stopped and refused food for the rest of the day. In the course of 36 hours after presentation, however, most of the mixture was consumed and, after the addition of a little green food, the rest was immediately cleared up. No pronounced symptoms were observed at any time, although it is quite possible that there were periods of slightly increased respiration. The interesting point, however, is that 5 M.L.D. were satisfactorily eliminated or detoxicated after gradual voluntary ingestion over a period of one and a half days. It should be noted that the 0·50 g. laevulose cyanhydrin, equivalent to about 45 mg. HCN (by silver nitrate titration) in 20 g. of bran corresponds to 2,250 mg. HCN per kg. or 2,250 parts per million. Faced with the choice of eating food at this high level of HCN, or of fasting, this particular rabbit solved the problem very simply by eating as fast as its " rate of elimination and detoxication " allowed it to do without fear. The same rabbit would have consumed rather over 65 g. of the same dry food over the same period if the cyanhydrin had not been added, and 5 M.L.D. in this would correspond to about 700 p.p.m. HCN. Hence this animal could have eaten normally to full capacity of appetite at a level of 700 p.p.m. in its total food, provided it adjusted its rate of consumption as before.

For the corresponding experiment on the dog, a lively and intelligent cross-bred terrier bitch, weighing 14 kg., was available. It may be worthy of mention that, a week before the experiment commenced, she displayed a mild attack of canine hysteria, and that enquiry showed that she had been exclusively fed on biscuits for at least several weeks before. A daily ration of ½ lb. of raw meat was substituted and no further attacks occurred. Thereafter, for a period of eleven consecutive days, 0·50 g. of laevulose cyanhydrin were mixed with 50 g. of minced meat and offered at 11 a.m. each day, the main meal of 250 g. of minced meat being given a few hours later, usually between 2 p.m. and 3 p.m. On all except three days, most of the 50 g. portion containing the poison was greedily eaten on an empty stomach. On the exceptional occasions about one-half to one-third was refused but this may have been due to some taint in the meat since even the 250 g. of untreated meat given later in the day was refused on these three days. The actual daily quantities consumed on successive days were 50, 47, 45, 50, 37, 24, 50, 50, 50, 26 and 50 g. No symptoms of poisoning were shown, although the 0·50 g. daily dose of cyanhydrin corresponded to 900 p.p.m. HCN in the meat consumed.

After a week's rest, the daily dosage of cyanhydrin in the 50 g. of meat was raised to 0·75 g., equivalent to 68 mg., or approximately 1 grain, of HCN. On the first day, this was apparently consumed although transfer of the animal to another building by an attendant may have masked partial rejection by regurgitation. On the second day, only half was consumed. On the third day, all was consumed but the greater part was subsequently rejected by vomiting. On the fourth day, most of the meat was refused. No symptoms were observed apart from the vomiting, which of course got rid of the poison. After a few days' rest 0·75 g. of the cyanhydrin was given in gelatin capsules to ensure complete intake and the day's ration of 250 g. minced meat was offered immediately afterwards. This was eaten in the course of a few minutes, and, about half an hour later, bile-stained vomitus was ejected. Otherwise the dog appeared normal and no definite symptoms of poisoning were observed. The suggestion is that the 0·75 g. of cyanhydrin might have been fatal to this dog, weighing 14 kg., just as 1·50 g. was actually fatal for the previous dog, weighing 23 kg., but that the animal protected itself either by refusing part of the food or by vomiting after experiencing premonitory effects. The interesting point, however, is that she tolerated 0·50 g., or two-thirds of this amount, daily for eleven days without discomfort, or for eight of them at least if the poor consumption on three days be attributed entirely to the cyanhydrin and not to the taint in the meat. About two-thirds of the probable M.L.D. for a single meal was thus regularly eliminated or detoxicated without display of symptoms.

The implication of these experiments, both on rabbits and dog, in relation to cyanide poisoning in the general sense, seems to be quite clear: it is the actual dose absorbed after any one meal which is the important factor, and all other considerations are secondary to this in assessing the probable toxicity of material containing cyanogenetic substances. An animal disposes of sub-lethal quantities without ill effect in a comparatively short time and relatively large quantities can be consumed if consumption is spread over several meals. The factor determining fatal or non-fatal issue is the ***rate of absorption into the blood stream in relation to the rate of elimination from it and the rate of detoxication within the body.***

The nature of the mechanisms concerned in detoxicating and excreting cyanides has not yet been established with certainty. Cushny's text-book (1934) states that " prussic acid is changed to sulphocyanides in the tissues and is partly excreted in the urine in this form, while part of it undergoes further and unknown changes." Lander (1928) states that " elimination takes place through the lungs, the exhaled air having a faint almond-like odour," and also that " in the blood it is possible that ammonium formate is produced." Steyn (1934) considers that prussic acid is very rapidly absorbed from the intestinal tract and also eliminated at a very rapid rate by lungs and skin. Autenrieth (1928) quoted by James (1938) considers " cyanhydrin and thiocyanate (sulphocyanide) formation as possibilities, as well as hydrolysis to ammonium formate and oxidation," but we can now probably exclude cyanhydrin formation on the evidence of the present experiments. James also quotes the experiments of Sollman, Cohen and Gittens, Schechter and Klaassen, as evidence of at least partial pulmonary excretion, and himself found that in the case of the human subject the major part of a small dose intravenously injected (0·11 mg. NaCN per kg. body weight) was apparently excreted as HCN *via* the lungs ; about 15 to 20 per cent. of the test dose was, however, recovered in the urine excreted during the first half hour after administration.

Taking the evidence as a whole it is apparent that the combined effect of elimination through the lungs and urine, and conversion to non-toxic compounds within the body, provides a rapid and efficient means of disposing of ingested cyanogenetic compounds. Apart from the specific evidence here supplied by the experiments with laevulose cyanhydrin the broad fact is exemplified in the work of many authors, and in the accompanying table (appendix) will be found a number of results, recalculated where necessary to provide a basis for comparison, which illustrate this important practical point. From this it will be noted that as far back as 1910 Lander cites his own experiments on a heifer dosed on two successive days with the HCN equivalent of 22·5 grains (approximately 1,460 mg.) and of 30 grains (approximately 1,940 mg.) respectively. The second dose proved fatal within two hours, but the smaller dose, although actually three-quarters of the larger, produced " no notable result." As shown by the cyanhydrin experiments, quantities of about two-thirds the M.L.D. can be disposed of by the dog day after day without ill effect even when given in single daily meals, whilst the rabbit can dispose of successive ½ M.L.D. quantities at intervals of 2½ hours.

B.—General Observations on Cyanide Poisoning

These may be prefaced with the remark that the veterinarian should be wary of diagnosing cyanide poisoning merely on the evidence of presence of cyanogenetic substances found by chemical analysis. Unless he has actually observed symptoms quite characteristic of HCN poisoning he may easily make a faulty diagnosis and Lander's reference (1926) to plants containing cyanogenetic glucosides, but in which " one has not to deal here with simple cyanide poisoning," is well worthy of note.

One of the best instances on record of such a case is provided by the paper of Green and Andrews (1923) recording investigation of the toxicity of the bulbs of a South African flowering plant *Adenia digitata* (earlier known as *Modecca digitata*). The root of the plant was at once suspected of containing a cyanogenetic glucoside associated with an accompanying hydrolytic enzyme since " on section a faint odour of hydrocyanic acid was perceptible through the stronger turnip-like odour of the root as a whole." A picrate paper test immediately confirmed the impression and quantitative analysis showed the presence of 0·04 per cent. of easily liberated HCN. An adult merino ewe was drenched with an aqueous suspension of ½ lb. of freshly minced root, began to exhibit symptoms of poisoning within a few minutes, and within an hour was apparently *in extremis*. Within two hours, however, the animal was standing up again and on the following day behaviour was normal. In the case of the fatalities in human subjects which initiated the investigation the symptoms, however, as reported by the medical observer, were entirely different and the sheep was therefore retained under observation. On the third day, *i.e.*, over two days after an apparently complete recovery from the HCN poisoning, an entirely fresh set of symptoms developed and the animal died with enteritis and inflammatory lesions, which were subsequently shown to be due to a hitherto unknown toxalbumin analogous to ricin of castor seed, which the authors isolated and named " modeccin," and demonstrated as fatal in extraordinarily small amounts. The quantity present in the plant was such that very small amounts of the bulb were fatal after a varying latent period which could be extended from one day up to about four days by reducing the dose. The plant thus contained two poisons of entirely different character ; a cyanogenetic glucoside with a rapidly acting accompanying hydrolytic enzyme, *i.e.*, a combination fatal within an hour if sufficient of the plant were ingested, and a toxalbumin fatal with very small quantities of the plant but with a latent period varying from one day to several days according to the amount consumed. If the victims survive the immediate respiratory distress characteristic of the first, they inevitably succumb with the gastro-intestinal symptoms characteristic of the second.

Spontaneous recoveries of apparently moribund animals, similar to that of the sheep just mentioned, have also been recorded in experimental KCN poisoning of rabbits, sheep and pigs, while cattle are stated to have recovered after showing quite pronounced symptoms (Steyn, 1932 ; Clawson, Bunyea and Couch, 1934 ; Couch and Bunyea, 1939). In the case of the dog every veterinary surgeon who has used prussic acid for disposing of unwanted dogs is probably familiar with the phenomenon and a case observed personally by the author may serve as an illustration. An aged Irish setter, which had been " left for dead " after an intended fatal dose of 4 per cent. HCN solution by mouth was found to be running about the following morning. It was recollected by the veterinary surgeon, in whose practice this occurred, that his predecessor had made a custom of dumping carcases of dogs, destroyed by prussic acid, on a loaded manure cart on its way to a farm some miles away. It was apparently not infrequent for sudden recoveries to occur *en route*, these being ascribed in those earlier days to the revivifying effect of the ammonia in the manure !

Similar spontaneous recoveries of apparently moribund animals may occur also in dogs exposed to HCN

in gaseous form, and Barcroft (1931) in the experiment mentioned above, describes how a dog which had ceased to respire and had been set aside for burial after being dragged out from the testing chamber as dead " did in point of fact recover and was found walking about next morning."

Alleged Chronic HCN Poisoning

Steyn (1934) discusses the alleged occurrence of chronic prussic acid poisoning in man, described by several German authors, but records his own failure to produce the phenomenon in sheep or rabbits by " drenching them at 24-hour intervals with toxic but non-lethal amounts of potassium cyanide for periods up to one month." The eleven-day experiment with cyanhydrin on the dog, reported above, also shows absence of any cumulative effect of repeated daily administration of doses fairly close to the " minimum lethal." Provided the cyanide radicle is not being absorbed more rapidly than the effective excretory and detoxicating mechanisms of the body can deal with it, an animal will survive without ill effects and even without symptoms; once the threshold is crossed severe symptoms or death will ensue. Indeed Steyn (1932) claimed, on what is perhaps insufficient evidence, that some degree of tolerance on the part of the rabbit to KCN poisoning could be induced. If, however, there is any validity in Steyn's limited observations in this direction, they render even less probable any alleged cases of delayed or cumulative cyanide poisoning from ingestion by animals of food-stuffs such as linseed cake containing small amounts of cyanogenetic glucoside, or ingestion by man of fumigated dried fruits containing residual cyanide and laevulose cyanhydrin.

Since, however, the assumption of cumulative toxic effects of small amounts of HCN seems to be more freely made in medical than in veterinary literature, the present writer conducted an experiment on himself in the hope of demonstrating that man is " only another animal " and no exception to the apparent general rule. The subject may be described as a healthy male aged 24, weighing 65 kg. The daily dose selected was intended to be about 21 mg. or one-third of the " one grain HCN equivalent " commonly regarded as a minimum lethal dose. It was taken in the form of 0·20 g. laevulose cyanhydrin in 50 g. of oatmeal flour or chocolate daily for eight days, actual analysis of the sample of cyanhydrin giving the precise HCN equivalent as 18 mg. per day. Laevulose cyanhydrin itself was noted to be distinctly unpalatable but its taste was effectively disguised by the oatmeal. Soon after a dose was consumed, observing bystanders reported a distinct odour of bitter almonds in the breath of the subject, suggesting rapid absorption and elimination *via* the lungs, but no subjective symptoms were experienced and no obvious increase of respiratory rate was noted. No ill effects whatever were experienced at the end of eight days, by which time the small stock of cyanhydrin had run out.

With regard to the real danger point of HCN taken as a single dose, Harvey and Hill (1940) may be regarded as the extreme in their statement that " one-twentieth of a grain is fatal to man " (route of administration not stated). This is little more than 3 mg., a quantity generally regarded as safe for medicinal use (U.S.P.). A more commonly accepted M.L.D. is 20 times this amount, 1 grain or 65 mg., but if present in food or taken on a full stomach with consequent slower passage into the duodenum, there should be no danger until 1½ grains or about 100 mg. is ingested, and even this estimate is probably conservative; the daily ingestion of 18 mg. " HCN equivalent," for eight consecutive days, in 50 g. of oatmeal consumed within a few minutes by the present writer, represents rather less than 2 ozs. of a foodstuff containing 360 p.p.m. HCN. Although this quantity proved harmless in the ordinary sense, it does not, of course, follow that very long continued ingestion would be without effect on general metabolism. Cyanides are known to depress certain oxidative processes in the body (see Commoner, 1940), an influence which can normally be counteracted by increased activity of the thyroid gland. As mentioned by Green (1938) if the food is not abundant in iodine a " relative shortage " of this element may be created and thyroid hyperplasia ensue. In this sense cyanogenetic compounds may be regarded as " goitrogenic substances."

Occurrence of Accidental Cyanide Poisoning in Veterinary Practice

The only types of poisoning likely to be encountered by the practitioner would fall into three categories, (*a*) that due to carelessly exposed or accidentally administered cyanides, (*b*) that due to contaminated foodstuffs containing easily available cyanogenetic substances in amount sufficient to supply a minimum lethal dose at a single meal, and (*c*) that due to plants or plant products containing cyanogenetic glucosides, the action of which may be modified by the method of preparation before ingestion or by factors operating in the alimentary tract. To this last class would belong materials such as linseed cake, the liberation of HCN from which may be delayed in the alimentary tract to such an extent that it can apparently be disposed of as fast as absorbed.

It is most important that veterinary practitioners should have a correct appreciation of the nature and likelihood of HCN poisoning in any given case, particularly as a professional diagnosis may well have legal implications and lead to a costly lawsuit in which exact evidence will be demanded.

Whereas cyanogenetic glucosides are to be found in varying amounts in thousands of plants, it by no means follows that such plants, or products derived from them, are dangerous. Even if a potential danger exists, it depends upon the *actual quantity of available HCN absorbed within a short period* whether or not poisoning will occur. The presence of cyanogenetic (cyanophoric) glucosides in plants is simply a reflection of their own metabolism and there have been many interesting studies of the botanical occurrence of HCN, and of its variation in amount, not only in different plants, but in the same plant from time to time. The textbooks of Lander and of Steyn should be consulted for accounts of cases of poisoning attributed to poisonous plants themselves, and further references may be obtained from Henrici (1926), Steyn (1934), Rogers, Larson and Spracher (1937), Gortner (1938). Hydrocyanic acid is a normal intermediary product of plant metabolism and probably a step in the conversion of nitrates absorbed from the soil into final plant proteins. So long as the rate of subsequent utilisation of HCN exceeds the primary rate of production, no cyanogenetic product is apparent in the plant, except in those cases in which, for unknown reasons, considerable quantities are stored. If some factor such as wilting

or frosting interferes with normal plant metabolism, and HCN is not used up as fast as it is formed, appreciable amounts may make a temporary appearance in quite common grasses. The appearance of considerable amounts of HCN in " frosted sorghum " is a case in point and Henrici made interesting observations on the appearance and disappearance of HCN in veld grasses in Bechuanaland. In the early morning when the grasses were dewy and turgid no HCN at all might be detected, but on partial wilting in the hot sun at noon very pronounced reactions to the " picrate paper test " were given, which disappeared again when flaccidity was replaced by normal turgidity. The actual amounts of HCN in certain grasses were quite considerable although they could rarely be incriminated as dangerous to stock.

In Great Britain the commonly used linseed cake is perhaps most often suspected as a source of poisoning in livestock, although generally on inadequate grounds. According to Lander (1926) an average yield of 1·75 grains per lb. (*i.e.*, 250 mg. per kg.) may be expected from linseed cake, but much higher values, up to 6 grains per lb., are apparently encountered in occasional imported samples, and values of about twice Lander's presumptive figure are common in Calcutta cake.

With regard to real and fancied dangers of linseed cake, the recent case of Drummond *v.* Paterson and Son, on which judgment was issued in the Sheriff's Court at Kilmarnock on September 14th, 1939, is of special interest to veterinarians, since the suit was instituted owing to the faulty diagnosis, backed by faulty expression of opinion by a county analyst. Judgment was given with costs against the farmer and in favour of the vendor on the grounds that the Pursuer *had failed to prove* :

1. That the linseed cake supplied by Defenders to Pursuer had an abnormally potential high rate of yield of hydrocyanic acid.

2. That scouring or persistent scouring is a symptom of prussic acid poisoning.

3. That feeds of ⅓rd lb. of cake with a potential yield of 3·85 grains per lb. of hydrocyanic acid given twice daily to calves in the usual manner and with other articles of food, such as cooked maize and sheep and lamb cake, as well as vegetation obtained by the animals while grazing, are capable of impairing the function of animals so as to result in chronic prussic acid poisoning or chronic and permanent scouring.

4. That the illness from which the Pursuer's cattle suffered was due to the cake supplied by Defenders to Pursuer for feeding his cattle, or that the cake was unsuitable as such.

As indicated by the findings, it was not shown to the satisfaction of the court that anything in the nature of chronic HCN poisoning could occur in the circumstances of the case, and in the words of the summing-up by the judge, as they appear in a copy of *Interlocutor* ; "All the experts seem to be agreed that in the case of a lethal dose, the history is administration, absorption at once and the animal roars, gasps for breath, falls down staggering, has convulsions, coma and death follows quickly on the administration. They also seem to be agreed that the symptoms of a sub-lethal dose are absorption and symptoms, similar in kind but less in degree follow, but there is quick recovery within half an hour." (For an account of this case, see *The Millstone* for October, 1939. **21.** 116-120, published by British Oil and Cake Mills, Ltd., London.)

Negative results in attempts to produce HCN poisoning by feeding linseed cake have been recorded by Voelcker (1909) Lander (1910-1911) and Tocher (1935, 1939), and some of these were utilised in the above lawsuit. These results, together with those presented as evidence by Professor Miller, and further data from Tocher's work with pure HCN and KCN, are given in recalculated form in the accompanying appendix table. Miller cited experiments on two calves in Camden Town in which linseed cake of higher HCN potential than that of the Defendants was fed in quantities increasing up to 3·2 lb. daily, or over three times the quantity fed by the Pursuer. At the end of three weeks one calf was killed ; *post-mortem* examination showed not the slightest trace of ill effects. The other calf continued on the ration with increasing amounts of linseed cake until after 45 days it was receiving sufficient to supply a potential yield of 12·8 grains of HCN per day, an amount ten times greater than that received by the cattle of the pursuant farmer. Despite this it continued to thrive, with an average gain in live-weight of 1·87 lb. per day. Evidence was given also concerning factors inhibiting generation of prussic acid from linseed cake in the alimentary tract, and it was indicated that acidity, alkalinity, the presence of cellulose, sugar, and other foodstuffs, might all reduce the toxicity theoretically deduced from mere analytical data on " HCN equivalent " of the cyanogenetic glucoside. It is hoped that the relevant experimental data will be published in detail by Professor Miller, but meanwhile it is apparent that anything approaching a fatal potential yield of HCN is highly unlikely to arise from ingestion of *dry* linseed cake in normal husbandry practice. The total quantity taken at one feeding time is usually insufficient, and the passage of a few hours between feeding times allows for elimination and detoxication even apart from the likelihood that there are factors delaying the liberation of the cyanogen radicle in toxic form.

SUMMARY

(1) The toxicity of the compound laevulose cyanhydrin, sometimes formed in the fumigation of certain foodstuffs by hydrocyanic acid gas, is shown to be of a high order, apparently proportional to its actual HCN equivalent. Conditions within the alimentary tract of both dog and rabbit apparently favour dissociation into laevulose and toxic HCN and not hydrolysis to non-toxic hydroxy-acid and ammonia.

(2) Laevulose cyanhydrin was administered in high daily but singly sub-lethal doses to the dog, rabbit and human subject, without ill effect. It is emphasised that, following ingestion of the cyanide radicle in any form, symptoms are determined by *rate* of elimination and detoxication of HCN in relation to *rate* of absorption into the blood stream, and that it is the actual amount of potential HCN absorbed at any *one feeding time* which determines the toxicity. An interval of two and a half hours is sufficient to enable a rabbit to dispose of ½ M.L.D. and repeated dosage at this rate has no cumulative effect.

(3) The findings are discussed in relation to alleged cases of HCN poisoning of plant origin, and in particular to those ascribed to the feeding of linseed cake.

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* From I.B.A.H. reprint collection.

APPENDIX TABLE

Summarised Data of Certain Experiments with Linseed Cake and other Cyanogenetic Substances

Species.	Substance.	Actual Dose and Method of Administration.	Calculated Dose of HCN.		Calculated HCN Content or Potential Yield of Material.	Observations.	Author.
			Total.	Mg./kg. Body Weight.			
Sheep	Linseed cake (Calcutta Cake) 0·051 per cent. HCN				510 p.p.m.	"Sheep refused to eat unless kept without other food"	Voelcker (1909)
Sheep	Linseed cake 0·025 per cent. HCN	1 lb. *per diem* for 36 consecutive days	114 mg. per day		250 p.p.m.	"No result"	Lander (1910-11)
Sheep	Linseed cake 0·025 per cent. HCN	1 lb. *per diem* for 31 days, 5 lb. for 2 days and another 5 lb. after 7 days	114 mg. to 570 mg. per day		250 p.p.m.	"No result"	Lander (1910-11)
Six-months heifer	Linseed cake 0·025 per cent. HCN	Increasing amounts; finally 5 lb. *per diem* for 30 days	570 mg. per day		250 p.p.m.	"No result"	Lander (1910-11)
	KCN	61·0 grs. in food over 10 days, including 15 grs. on each of 2 days	Up to 404 mg. per day		—	"No result"	
		Equivalent of 22·5 grs. of HCN as gentian ball inserted into rumen	1,458 mg.		—	"No noticeable result"	
		Equivalent of 30 grs. of HCN as gentian ball inserted into rumen	1,944 mg.		—	Fatal within 2 hours	

Species.	Substance.	Actual Dose and Method of Administration.	Calculated Dose of HCN.		Calculated HCN Content or Potential Yield of Material.	Observations.	Author.
			Total.	Mg./kg. Body Weight.			
Pig	Linseed cake 0·02 per cent. HCN	2 lb. were fed for 2 days	182 mg. per day		200 p.p.m.	Remained quite normal in health and showed no evidence of poisoning	Tocher (1935)
	HCN	Two capsules containing 2½ grs. of the acid	162 mg.		—	" Remained quite normal and showed no ill effects "	
		Capsules containing 6·16 grs. of the pure acid	400 mg.		—	Animal died in half an hour	
Pig	KCN	Quantity capable of yielding 48 grs. of HCN mixed in ration	3,110 mg.			Eventually eaten after at first refusing. " No ill effects "	Tocher (1935)
		Capsule containing the equivalent of 48 grs. HCN	3,110 mg.		—	Fatal in 16 minutes	
Young bullocks 3¾-4¼ cwts.	Linseed cake 0·046 per cent.	Quantities of the glucoside and of linseed cake, equal to from 1-8 grs. HCN fed in maize for 1 month	Up to 520 mg. per day	Up to about 2·5 mg. per kg.	460 p.p.m.	" No ill effects "	Tocher (1935, 1939)
	KCN	Amounts capable of yielding 6 and 12 grs. HCN	390 and 780 mg.		—	" No ill effect "	
Pigs of known weight	KCN	Dosed in aqueous solution, with doses adjusted to actual HCN equivalent as determined by titration	Calculated as HCN on mg./kg. basis	0·27-7·0 mg./kg.	—	The M.L.D. where there was no emesis was 2·4 to 3·4 mg./kg. calculated as HCN. In 59 per cent. of the cases the animals vomited part of the dose. Eight survived much higher doses than the above. Toxic effects were obtained with a dose of 0·65 mg. per kg. and severe symptoms with doses of 0·86 to 1·9 mg. per kg. The smallest emetic dose was 0·84 mg. Pigs appear to be much more slowly affected than ruminants. " There was no indication of the establishment of tolerance or of increased susceptibility "	Couch and Bunyea (1939)
Rabbits (2 kg.)	Laevulose cyanhydrin	Doses of 0·05, 0·10, 0·15, 0·17 and 0·50 g. by stomach tube	4·5 up to 45 mg.	2·25 to 22·5 mg./kg.	—	Doses equivalent to 7·65 mg. HCN per kg. fatal. Dose equivalent to 4·5 mg. HCN per kg. fatal in one instance. Doses equivalent to 2·25 mg. HCN per kg. not fatal even when repeated at intervals of 2½ hrs.	Worden (1940)

Species.	Substance.	Actual Dose and Method of Administration.	Calculated Dose of HCN.		Calculated HCN Content or Potential Yield of Material.	Observations.	Author.
			Total.	Mg./kg. Body Weight.			
Rabbit (2 kg.)	Laevulose cyanhydrin	0·50 g. mixed in 20 g. of bran and consumed over 36 hours	45 mg. per 36 hours	22·5 mg. per kg.	2,250 p.p.m.	No effects noted	Worden (1940)
Dog (22·6 kg.)	Laevulose cyanhydrin	Increasing doses of 0·5, 1·0 and 1·5 g. given in 50 g. minced beef and consumed immediately	45-135 mg.	2·0-6·0 mg. per kg.	900, 1,800 and 2,700 p.p.m.	No untoward effects from doses equivalent to 2·0 and 4·0 mg. HCN per kg. bodyweight. Dose equivalent to 6·0 mg. HCN per kg. fatal in 2½ hours	Worden (1940)
Dog (14 kg.)	Laevulose cyanhydrin	0·5 g. daily for 11 days, given in 50 g. minced meat	45 mg.	3·2 mg. per kg.	900 p.p.m.	No symptoms whatever	Worden (1940)
		0·75 g. daily for 4 days, given in 50 g. minced meat	67·5 mg.	4·82 mg. per kg.	1,350 p.p.m.	Refused food or vomited following complete consumption	
Man (65 kg.)	Laevulose cyanhydrin	0·2 g. daily for 8 days, in 50 g. of oatmeal flour or chocolate	18 mg.	0·27 mg. per kg.	360 p.p.m.	No symptoms whatever	Worden (1940)
Calves of known weight	Linseed cake	Increasing amounts up to 3·2 lb. per day	832 mg.	6·35 mg. per kg.	521 p.p.m.	No symptoms whatever	Miller (unpublished observations)

FOOT-AND-MOUTH DISEASE

Foot-and-mouth disease outbreaks have been reported during the past two months or so in various districts, fairly widespread, throughout England and Wales—from Yorkshire in the north to Kent and Cornwall in the south. Whenever a farmer suspects foot-and-mouth disease among his livestock, it is his duty to report at once at the nearest police station, when the necessary steps will be taken immediately to have the suspected animals examined by an official of the Ministry of Agriculture's Veterinary Service, and the proper control measures put in operation should the disease be confirmed. Prompt reporting of suspected cases also allows the police to take certain precautionary measures against the spread of disease, even before the Ministry's inspectors have time to visit the premises concerned. Other duties of farmers in connection with the prevention and control of this disease are to keep a record of movements of livestock to and from their farm, and to boil all swill before feeding it to animals and, of course, in the event of foot-and-mouth disease being suspected on their farm, they must give the Ministry's inspectors facilities for making an inquiry. Should they fail in those duties, they are liable to be prosecuted. Citing two recent instances, the *Scottish Farmer* says: "Two Welsh farmers were prosecuted recently—one on four charges, and one on two charges—under the Foot-and-Mouth Disease Order of 1928. The first farmer was charged with not giving notice with all practicable speed of an outbreak of foot-and-mouth disease. After hearing evidence, the Court found him not guilty. It was stated that there had been no outbreak of the disease in that district or anywhere near it for 68 years; that the farmer first noticed a sow going lame, but she seemed to recover before other animals were affected; that, four days later, a cow was off her food and dribbling at the mouth; that, as there was no veterinary surgeon in the district, he called in a neighbouring farmer who, although he had never seen the disease, suspected it on hearing the symptoms, and took the precaution of disinfecting himself before going to see the animals; that, when he saw the animals, he went with the owner at once to report to the police. The Court had no difficulty in finding the accused not guilty of that charge; but he was fined £1 for failing to keep a record of the movement of three calves from his farm (to which he pleaded guilty), and £4 for failing to boil swill before feeding it to pigs—to which charge he pleaded not guilty, but was convicted. A neighbouring farmer was also fined £1 for failing to keep a record of the movement of the three calves to his farm. The last charge was that of failing to give facilities for an inquiry, and both farmers pleaded not guilty, but they were convicted and fined £5 and £6 respectively. Their offence in this case consisted in having said nothing about the movement of the three calves. The Bench held that 'if a person failed to answer the whole truth to questions put to him for the purpose of gaining information, he was not giving all the facilities necessary for that inquiry.'"

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The Political Correspondent to the *Daily Telegraph* says: "I understand that the Government is preparing for a drastic curtailment in the importation of food both for human and animal consumption. It is the intention to conserve shipping space by concentrating on imports which yield the highest return in nutritive value. Simultaneously new schemes to assess the home agricultural industry are being developed to increase next year's output."

Development of Certain British Veterinary Services Overseas

(*Continued from page 677*).

Veterinary Department—Nigeria

W. W. HENDERSON, M.R.C.V.S., D.V.S.M. (VICT.), Director of Veterinary Services

The need for a veterinary service in Nigeria as in the case of other African Colonies, was first brought home to the authorities by the decimating losses among the cattle population from cattle plague (rinderpest). When this disease was first introduced into Nigeria about 1889 through Eastern Bornu, it swept through the country annihilating the herds and leaving behind a trail of social suffering and economic loss. The cattle mortality was colossal, often reaching up to 90 per cent. and even 100 per cent. of a herd. Only a remnant of the stock remained from which breeding could be recommenced.

Since the introduction of rinderpest, wave after wave of the disease at intervals of a few years has swept the country, killing off large numbers of the susceptible progeny born since the last visitation.

No selective breeding was possible, for cattle owners, living in constant dread of the disease, were only too glad to have any type or description of cattle beast from which to rebuild their herds.

Such was the situation in Nigeria in 1914 when the Veterinary Department was established by the arrival of Mr. F. R. Brandt as Chief Veterinary Officer. He was preceded by a few months by Mr. G. E. Owen, Veterinary Officer. In a country the size of Nigeria, with its herds of nomadic cattle, such a small staff could do little more to stem the tide of the disease other than to make a preliminary survey and train African staff.

By 1917 eight Africans, including two from each of the provinces of Zaria, Sokoto and Kano, were appointed and by 1920 this number had increased to 44. To-day the staff of the Department consists of 32 Europeans and over 300 African assistants recruited both by Government and the Native Administrations.

Rinderpest Immunisation.—It was not until 1925, when a Veterinary Laboratory was established at Vom and producing anti-rinderpest serum, that it was possible to take any really effective steps to control the disease. In that year a camp was established at Mai Idontoro on the Jos Plateau where the work of immunising cattle against rinderpest by the sero-virus method was commenced. Cattle owners were at first naturally very shy of subjecting their cattle to artificial immunisation and by the end of that year only some 5,000 head had been done.

It was not long, however, before the good results of these early immunisations became known over the length and breadth of the country and native owners commenced to arrive with their cattle at Mai Idontoro Camp from such far off places as Sokoto, Katsina, Kano and Bornu. The demand for immunisation soon outstripped the resources of the department, but as the staff was slowly increased the immunisation scheme was extended both in scope and intensity until in 1939 there were 45 seasonal immunisation camps in operation throughout the Northern Provinces at places convenient to the nomadic habits of the cattle owners. In this year alone, 356,860 cattle received sero-virus inoculation and a further 356,326 received rinderpest spleen vaccination. The number permanently immunised in 1938 was actually higher, reaching a total of 407,000.

Cattle owners, now as part of their normal life, visit one or other of the immunisation camps every year or every second year to have their young susceptible stock immunised.

As a result of this large-scale scheme of prophylactic inoculation carried on continuously throughout these past years the greater proportion of the cattle population of the country is now immune and rinderpest to-day is well under control and occurs only in isolated outbreaks with a small mortality.

As long as the disease remains in Nigeria, even in isolated foci, and exists in the neighbouring territories, so long must the present costly campaign of prophylactic immunisation be continued here, if the disease is to be held in check and the herds protected.

Any increase in the proportion of cattle left susceptible as a result of a slackening off in the rate of annual inoculations will only supply the fuel for a disastrous conflagration of disease at some future date.

Rinderpest, even to-day, throughout the greater part of Africa is directly and indirectly the cause of enormous annual losses and its complete eradication from the Continent would be of inestimable economic benefit to all the territories concerned, by eliminating the serious wastage of stock and putting an end to the heavy recurrent expenditure involved in keeping the disease in check.

The eradication of this disease can be attained only by the simultaneous adoption by all the countries concerned of effective measures of control. At present there is no co-ordinated effort and each country is working independently on a scheme of self-preservation.

Vaccination Against other Diseases.—Rinderpest was not the only serious disease which called for the immediate attention of the department. A considerable mortality was occurring also from contagious bovine pleuro-pneumonia, blackquarter and other diseases which are now all being controlled by similar methods of large-scale prophylactic immunisation.

In 1939, 326,141 cattle received vaccination against contagious bovine pleuro-pneumonia, 545,449 against blackquarter, 51,655 against haemorrhagic septicaemia and 23,061 cattle were vaccinated against anthrax.

In addition, some 27,062 cattle received a course of curative injections for trypanosomiasis.

That is to say, during 1939 over one-and-a-half million inoculations were carried out by the department in connection with the control of disease.

Veterinary Laboratories.—The vaccines for all these inoculations, as well as the great bulk of the anti-rinderpest serum, are made at the Veterinary Laboratories at Vom.

In the first year of activities at the Laboratory at Vom, *i.e.* in 1925, its total output of laboratory products was 18,000 doses of anti-rinderpest serum. In 1939 the output had increased to 556,900 doses of 50 c.c. each of anti-rinderpest serum, 99,700 doses of rinderpest spleen vaccine, 340,315 doses of contagious bovine pleuro-pneumonia vaccine, 367 doses of anti-rabies vaccine and over 3,000 doses each of fowl typhoid and fowl pox vaccines. Apart altogether from the research work carried out, this large annual output of biological

products is a striking indication of the important part this institute is playing in the activities of the department. Three branch laboratories, one each at Kano, Maiduguri and Yola, are now also in operation, mainly for the production of anti-rinderpest serum and rinderpest spleen vaccine to augment the supplies from the Vom Laboratory.

Research.—The amount of research into local animal diseases over a period of 15 years has been very extensive and enables us to-day to have a comprehensive knowledge of all the debilitating conditions the local stock are heir to and the mode of control in a great many instances.

Animal Clinics.—Another important aspect of the work of the department is the training and supervision of the African staff employed at the animal clinics now established throughout the Northern Provinces.

The treatment of native-owned animals is free, and the work carried out at these clinics has been responsible for the relief of an enormous amount of animal suffering, especially in the treatment of cases of saddle and harness galls in pack animals and of lameness.

In 1939, with 24 clinics established, some 25,937 animals received treatment, many cases involving several daily visits.

Transport of Animals.—Attention is also given by the officers of the department to the rail transport of slaughter animals from Kano and other stations in the North to Lagos, as well as the ocean transport of cattle from Lagos to the Gold Coast. Some 37,500 head of cattle and 17,000 sheep and goats were railed to the coast in 1939.

(*To be continued*)

SWINE FEVER POSITION IN SUFFOLK

At a meeting of Suffolk Diseases of Animals Joint Committee the Clerk reported that since the last meeting there had been 888 reports of swine fever. "Quite the largest figure that I ever remember," he added. Of the total 251 were confirmed, 42 were awaiting determination and the remaining 595 were not confirmed.

Mr. C. C. Smith, the Chairman of the Committee, said the position was very disappointing and serious. At this time last year they had a considerable outbreak, but the position to-day was far worse. There was a suggestion that the disease was spread through the use of lorries which had carried pigs. They should do their utmost to see that the regulations on the cleansing of lorries were strictly enforced.

Major James, Supt. Veterinary Officer of the Ministry of Agriculture, said that almost anything might help to spread such a virulent disease. The boiling of swill was very important in the prevention of disease generally.

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It is becoming doubtful whether the scheme for livestock food rationing can be ready for operation by January 1st, as originally intended. It seems that many details have yet to be settled.

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We learn that as the result of a recent bombing raid the whole of the unbound stock of Dr. Bullock's "Law Governing Medical, Dental and Veterinary Practice" and of his "Handbook for Veterinary Surgeons" has been destroyed. Fortunately a few bound copies have been preserved. These will remain on sale without change of price until the edition is exhausted.

THE VETERINARY RECORD

December 14th, 1940.

THE EVOLUTION OF THE COLONIAL VETERINARY SERVICE

In no branch of our profession has there been such outstanding progress, in recent years, as in the Colonial Veterinary Service, despite the difficult conditions under which the Service has laboured. Up to, and for some years after the last war, the profession in the various British Colonies was not only numerically weak but it was hampered in enterprise by being subjected to the control of other professional bodies, notably Departments of Agriculture. In none of the Colonies was the Chief Veterinary Officer given full administrative authority to direct the policy of his section of the Department to which he was attached, in the manner which he deemed most suitable.

This subordination created a reactionary spirit in the veterinary staffs of some of the colonies; particularly was this so in Kenya Colony or British East Africa as it was then known. It was fortunate that at the head of affairs in this colony the profession then had some able and ambitious pioneers, notably Colonel R. J. Stordy and the late Mr. Eustace Montgomery. These two men in particular must be credited with the initiation and prosecution of a campaign to raise the profession from its undesirable state of subordination and relative impotence to the unique position of independence and vigour it has now reached. The spirit emanating from those pioneers imbued their successors and spread to other places with the result that the Local Governments concerned took notice of the position in time, and eventually in 1926 the Colonial Office set up a special committee under the Chairmanship of Lord Lovat to investigate the claims of the profession in the Colonies.

The principal findings of the Lovat Committee were: —

(1) The creation of a unified Colonial Veterinary Service. Salaries: from £600-£750 to £2,000-£3,000 for the highest grade.

(2) The appointment of an Adviser on Animal Health to the Secretary of State for the Colonies and the establishment of a Consultative Committee of Animal Health, and a Colonial Advisory Council of Agriculture and Animal Health.

(3) The establishment of a school of tropical veterinary science, modelled on the lines of the London School of Tropical Medicine, in the tropics, preferably in East Africa.

(4) That the conditions under which veterinary officers are trained in Great Britain should be fundamentally improved, the ordinary training for the diploma of the Royal College of Veterinary Surgeons not being, in the Committee's opinion, sufficient for these officers.

This was the turning point in the chain of events that led up to the emancipation, but the recommendations of the Committee were not implemented at once. In fact they are only partly implemented now; yet the benefits already gained are considerable. The profession is now master of its own affairs in the principal colonies and after a long and painstaking campaign, with the help of the National Veterinary Medical Association, it has obtained the services of an Adviser at home. The salary position is improved but not fully rectified and the facilities for research in some colonies require attention. There is every reason to expect that, with the establishment of the new feeling of goodwill and co-operation between the Colonial Office and the profession, with the advent of the new Imperial Grant for Colonial Development and the presence of a Veterinary Adviser at the Colonial Office, these and other oustanding questions will receive sympathetic attention.

What of the future? It seems obvious that with the enormous numbers of livestock and the devastating diseases to which they are subjected there is a vast field of enterprise lying ahead of our profession in our Colonial Empire. It now falls on the shoulders of our profession to control these diseases and to reduce the huge monetary loss involved. To be found wanting in a responsibility of this magnitude would decry our claim to self-determination and reliance. Men of the highest ability and energy must be enrolled in the Service for this purpose and conditions must be suitable for them to prosecute the work. Facilities should also be provided to give new recruits to the Service a period of special practical training, so that they may become active partisans in the campaign with the least possible delay after their appointment. Ecology in relation to disease-control is of fundamental importance in the Colonies and no amount of academic tuition at home will alone fit new men for posts in the "field" service abroad.

Expansion of the Service now seems a *sine qua non* and we hope many of our young graduates of the right type will enter it; for them, indeed, the future seems a particularly bright one.

More than 800 Shetland cattle in the islands of Bressay and Uist have passed three successive tuberculin tests and have been registered as tubercle free. Owners are thus entitled to £1 per head per annum for three years. The extension of the scheme to other parts of Shetland has been presented by the war.

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It is learned that considerable progress is now being made with the collection of kitchen waste for stock feeding, although much remains to be done. It is estimated that 500,000 tons of waste food or swill could be salvaged every year from the urban population of the country, largely from private households. This food supply would avert to some extent a drastic reduction in our pig and poultry population owing to lack of imported feeding stuffs. Latest figures show that 235 local authorities carry out organised collections, and are saving more than 5,500 tons of kitchen waste per month. About 800 local councils have arranged for private persons to collect swill in their areas.—*Meat Trades Journal.*

CLINICAL COMMUNICATION

Castration of the Racing Greyhound

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Subject.—A red fawn greyhound, aged two and a half years, in perfect health but of a vicious disposition.

History.—This dog had been track racing for one and a half years and was very fast. He had, unfortunately, a strong tendency to savage any dog who challenged him. The question arose, if the dog was castrated would it reduce his speed and tend to make him lazy? It was decided, however, to perform the operation.

Operation.—The dog was given ½ grain of morphine subcutaneously and in three-quarters of an hour's time a fair degree of narcosis was evident. Nembutal was given by the intravenous route. The dog fought and struggled during the administering of the injection and it was consequently difficult to estimate the degree of anaesthesia. After 6 c.c. of nembutal had been given a good degree of anaesthesia was evident, the pedal reflex still being fairly strong, and at this point it was decided to operate.

However, after the site had been shaved, cleansed, etc., respiration failed quite suddenly. Artificial respiration was resorted to, and in about five minutes the dog began to breathe again. In 15 minutes the respiration and pulse were good; the operation therefore was continued. This was carried out in the usual manner, except perhaps as regards the site, which was slightly to the side of the spermatic cord in the inguinal region. The testicle, by traction on the cord, was drawn through the incision and removed, after a catgut ligature had been placed on the vascular portion of the cord and also on the vas deferens. The skin incision was closed by interrupted sutures of silk. The other testicle was removed in a similar manner.

Outcome.—On recovery from the anaesthetic the dog was extremely violent. Fortunately no damage was done and the animal went home the same day with his owner. The sutures were removed in seven days' time and in a fortnight the dog was back in training. The owner assures me that the dog has lost none of his speed, in fact in one race equalled a track record. When racing he shows none of his former vicious trait.

ZOO ANIMALS AND AIR RAIDS

Professor Julian Huxley, in a recent broadcast, said that A.A. guns and even bombs seemed to have singularly little effect on the animals at the London Zoo, even those considered specially nervous. When a bomb fell near the camel house they found the camels sitting down peacefully chewing the cud, and he wouldn't be surprised if they hadn't bothered to get up at all.

The zebra house got a direct hit one night. By a miracle none of the occupants was killed or even hurt, apart from a few bruises and scratches. The female wild ass got out of her stable into the paddock, while her foal escaped at the back and wisely took refuge in the stoke-hole under the hippo house, where she was found next morning.

A zebra was liberated into the garden and after being sighted by the light of incendiary bombs made his way through the tunnel and out through the gate, which the fire brigade was using. He headed for Camden Town. Keepers set out in pursuit and by a combination of coaxing and driving he was without much difficulty got safely back and into an empty store shed.

ABSTRACTS

[GLANDERS IN ARMY HORSES. Dildine, S. C. (1939.) *Vet. Bull.* (Suppl. *Med. Bull. U.S. Army*). **33**. 98.]

Glanders is at the moment rare in animals of the army stationed in the United States but in some of the foreign stations outbreaks are rather frequent. It is prevalent in China ; as many clinical cases are observed the U.S. army authorities endeavour to prevent any contact between their own animals and those from outside sources. Although not officially verified it is believed that many animals belonging to the contending armies in China at present have been lost through glanders infection.

A description is given of two cases of glanders in army horses which occurred in China in 1937 shortly after returning from a summer training camp. It is thought that some unknown contact with outside horses must have been made for the official precautions taken appeared adequate.

The first horse affected was depressed with an elevated temperature, and a slight mucous discharge from both nostrils ; by August 21st it had developed cutaneous glanders which clinched the diagnosis. When tested with mallein on August 13th this horse had given a negative result. The diagnosis was confirmed by the *post-mortem* findings and the recovery of *Pf. mallei*. A further case developed in one of the contact horses.

The author comments on three points :—

(*a*) The negative reaction to the intradermal mallein test by the horse which was infected ;

(*b*) The acute and virulent form of glanders, which in horses is usually chronic ;

(*c*) That the temperature readings of all contact animals enabled him to pick out within eight days of exposure, the only case of glanders developing from the original case. It would therefore be useful to know whether all animals have an elevated temperature in the early incubative stage of glanders.

R. L.

* * * * *

[I.—THE RELATIONSHIP BETWEEN THE MALLEIN REACTION AND CHANGES IN THE SPLEEN IN 300 MONGOLIAN GLANDERED HORSES ; II.—THE RELATIONSHIP BETWEEN THE MALLEIN REACTION AND THE CHANGES IN THE NOSE IN 300 MONGOLIAN GLANDERED HORSES. Itikawa, O. (1940.) *Jap. J. vet. Sci.* **2**. 296 and 317.]

I.—The frequency of glandered nodules in the spleen of infected horses is shown to be 47·3 per cent., for they were present in 142 of 300 examined. The nodules are usually small in number but the author claims a relationship between the number of nodules and the mallein reaction. It is stated that the relationship is in direct proportion—the greater the number of nodules the greater the reaction. Most of the nodules are in the capsule, the number given being 130 of 142. There also appears to be a direct relationship between the size of the nodules and the mallein reaction.

The frequency of an enlarged spleen is expressed as 72 per cent., the numbers being 216 of 300. In this type of spleen change the reaction to mallein may vary from a strongly positive to a negative and furthermore in enlarged spleens any nodules present may be obscured.

The frequency of infection in other organs in horses with splenic glanders is shown by the following percentages : lungs 99, nasal septum 54, liver 50 and the skin 30.

II.—The second paper deals with nasal glanders and of 300 horses with glanders there were 151 with the nasal form—50·33 per cent. There is a division into types according to whether there are ulcers, nodules or scars but it is pointed out that in many cases there may be ulcers, nodules or scars alone or, on the other hand, a mixture of any two or three. There was a nasal discharge in 65 of the 300 horses and this occurs with any form of nasal glanders. Tables are given in an attempt to show the existence of any relationship between the form of the nasal glanders and the mallein reaction but little can be gleaned from them. The lungs were affected in 99 per cent. of cases and it is concluded that nasal glanders is therefore a secondary change.

R. L.

REPORT

[KENYA COLONY AND PROTECTORATE. Report of the Veterinary Department, 1938.]

This is the first annual report of the recently created Department of Veterinary Services. Up to 1937 the veterinary services of the Colony formed a Division of the Department of Agriculture, and, consequently, were subject to the controlling influence of the Director of Agriculture. The institution of an independent Veterinary Department is a notable event in Kenya because for many years much publicity has been given to the merits of such a change there. It is a notable event, too, in the evolution of our profession in public affairs, from inconspicuity and subservience to prominence and reliance, because such recognition by a Government of the importance of that of Kenya is no insignificant matter. With this change in Kenya all the larger Colonies are now in line in having independent Veterinary Departments. This is a satisfactory development and will allow the profession a freedom of activity which, one feels confident, will justify the trust placed in it.

The Director (Mr. Daubney) outlines the general policy of the new department in the introductory section of the report. Here are two extracts from his remarks : "The future of agriculture in Kenya is closely bound up with our ability to develop a strong and balanced livestock industry ; one may even say that without a sound animal industry the future of agriculture in this country of uncertain rainfall will always remain precarious to a degree."

"Another aspect, and one which is of no less importance to any government charged with the care of purely agricultural native tribes, is the effect which development of a suitable form of animal industry can exert on the nutritional state of the people." He elaborates both these statements by statistical data, and makes a convincing case for his policy of development of the livestock resources of the country. But he points out that there are several limiting factors operating against this development, of which the greatest is the continued existence of two major cattle diseases, namely, rinderpest and East Coast fever. And

it is here that the great advantage of a veterinary Directorate in livestock affairs in a country like Kenya comes in, for the expert mind can apportion to the influence of such destructive diseases its correct implications and act accordingly. Mr. Daubney is optimistic of his capacity to overcome these difficulties and he hopes to be in a position in the near future to have surplus livestock for overseas shipment.

In the disease control section rinderpest occupies a prominent place. Goat-adapted virus has given satisfactory results in actively immunising cattle. At the time of writing "field" use of this virus on a large scale had not been undertaken, however. Mention is also made of a Rinderpest Conference held in Nairobi in February, 1938, at which, amongst other things discussed by representatives of East and South African delegates, was the complete eradication of the disease from East Africa. As was pointed out in a previous note in this journal on the Annual Report from Tanganyika, rinderpest caused a scare in South-Eastern Africa in 1938, by a southward extension through Tanganyika, and the veterinary authorities have felt that the eradication of this pest from East Africa has become urgent.

In the animal-husbandry section there is an interesting discourse on the advantages and drawbacks of grading from native stock with European breeds, but the most significant feature of this section is the capacity of selected native cows, kept under European conditions of care and management, to yield large quantities of milk, quantities which are approximately double that produced by ordinary Zebu cattle living under native conditions. For example, one such cow yielded 505·5 gallons of milk with 5·5 per cent. butter fat in 278 days, and another 336·5 gallons with 5·9 per cent. butter fat in 284 days. Such yields augur well for a potentiality in native resources which those of us who knew the conditions out there in the past never considered possible. With such high-yielding stock that happen to enjoy some resistance to indigenous diseases, it would seem superfluous as well as hazardous to go in for European dairy cattle on a large scale until the disease position is more satisfactory.

In the native veterinary education section it is pointed out that there were five training centres for pupils in animal husbandry and disease control. This movement is highly commendable and is making prominent headway in many of the Colonies.

A notable section in the report—as it always is from Kenya—is the report on research work. Experiments were conducted on rinderpest, contagious bovine pleuro-pneumonia, tsetse flies, oestrus and other subjects, but in the space available there can only be mentioned, in particular, a coital disease of cattle which causes a serious amount of sterility in the Colony and which is set up with bacteriologically sterile material. A virus was suspected but at the time of writing no definite opinion as to the nature of the cause was given. Both bulls and cows become affected and become sterile. The use of artificial insemination has become a routine method of preventing its spread.

The remaining sections of the report deal with administrative and other routine activities.

W. K.

The Minister of Food announces that the Government are to build 20 more cold storage depots. They will be away from the ports, and built on a standard but smaller model than the eight large depots now under construction.

IN PARLIAMENT

The following are among questions and answers recently recorded in the House of Commons:—

HUNTING (PROHIBITION)

Mr. LEACH asked the Minister of Agriculture whether he is aware that people connected with hunting are now admitting that hunting is unpatriotic during the war, and that its practice should, therefore, be kept as quiet as possible; and whether he will now consider its prohibition in the national interest?

Mr. HUDSON: I am satisfied that the prohibition of hunting is not necessary in the national interest.

. . . . .

SYNTHETIC VITAMINS

Sir E. GRAHAM-LITTLE asked the Parliamentary Secretary to the Ministry of Food what contracts have been placed for erecting the factory for the manufacture of synthetic B_1, for equipping the same, and for staffing the establishment; will other synthetic vitamins be manufactured here; if so, for what purpose; and, in particular, is it proposed to supply farmers and stock-breeders with synthetic vitamins in place of the natural food of cattle and other stock?

Major LLOYD GEORGE: The only factory which is at present capable of producing the synthetic Vitamin B_1 on a scale sufficiently large for its introduction into white flour has been erected as a result of private enterprise by a firm of chemical manufacturers. I am not in a position to give details of the contracts which have been placed by the owners of the factory, nor of the staffing of the factory, for neither of which is the Ministry of Food responsible. My Noble Friend understands that the same manufacturers are engaged in the manufacture of the antiscorbutic vitamin, but he is not aware of any proposals to supply farmers and stock-breeders with synthetic vitamins for use as feed for their livestock.

NOTES AND NEWS

The Editor will be glad to receive items of professional interest for inclusion in these columns.

Diary of Events

Dec. 18th.—**Emergency Meeting of Council, N.V.M.A., and of Veterinary Surgeons in the London Metropolitan Area,** to discuss the future operation of the National A.R.P. for Animals Committee at Conway Hall, Red Lion Square, W.C.1, 2 p.m.

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Evacuation of Children to Canada

Arrangements in Progress by the Ontario Veterinary Association

In our issue of July 6th we reported the receipt, and grateful acceptance, jointly by the Royal College of Veterinary Surgeons and the National Veterinary Medical Association, of the prompt and generous offer made by the members of the Ontario Veterinary Association to assist individually and collectively, through the Dominion Commission, in caring for the children of those veterinarians in Great Britain who contemplated evacuating their children to Canada. Accordingly, members interested were requested to communicate with the General Secretary, N.V.M.A., but these enquiries, and the requisite preliminary negotiations with travel agents had scarcely been instituted when Government announcement of temporary suspension of evacu-

ation was made. Nevertheless, as veterinarians on this side will learn with much appreciation from the letter reproduced below, our Canadian colleagues are pressing forward with their humane and hospitable project and are doing everything within their power to ensure that when the operation of the scheme is resumed, not only will the children concerned be placed in suitable home environment, but their well-being will have the added safeguard of subsequent maintenance of contact between the host-organisation and the evacuees. Following is the letter addressed by the President of the Ontario Veterinary Association to the President of the National Veterinary Medical Association of Great Britain and Ireland: —

Ontario Veterinary Association

H. W. Steele-Bodger,
36, Gordon Square,
London, W.C.1.

Dear Doctor,

In answer to your communication of August 7th, our Executive held a meeting and decided after interviewing the Children's Aid Society to make arrangements for the allocation of 25 or 30 children, the number you mentioned in your last communication.

We have requests from our members for ten or twelve children, and are making arrangements through the Children's Aid Society to look after the remainder until such time as we can find homes among our members or their friends for them.

I believe that all children must come through the Children's Aid Society and their officers in turn inspect prospective homes to make sure they are going into suitable homes and also keep in contact with them afterwards.

I hope you will forgive my delay in replying to your letter, but before I had a report from the committee who were to interview the Children's Aid Society word came through that evacuation had again ceased, but in the spring should it again be renewed we hope to be of some help to you as we feel very helpless when we listen to the news of the war.

Best regards and wishes for your association.

I remain,
Yours very truly,
J. E. Johnson,
President.

36, Erb Street East,
Waterloo, Ontario.
November 4th, 1940.

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A Christmas Gift Appeal

As our readers have lately been reminded, the tragic happenings which prompted the charitable impulse of our Canadian confrères, which is the subject of our first note this week, have also stressed the vital necessity of the fullest exercise of benevolent instincts at home, for they have thrown an unprecedented strain on the slender financial resources of the charitable agencies of the profession. It is, therefore, with the greater pleasure and appreciation that we learn, from the letter from the President of the Victoria Veterinary Benevolent Fund published on another page, that among the worth-while things to be carried on, despite the war, as in normal times is the Special Christmas Fund by means of which seasonably timely additions are made to the allowances of beneficiaries.

Moving letters in possession of the Fund reveal how much the thoughtful generosity of those who respond to this annual appeal means to the dependants assisted, not only in material comfort but as a token of kindly remembrance and goodwill. The "back-handed" compliment some readers pay us by turning first—as they assure us—to our Correspondence columns will be forgiven, this week, if such have already written out their cheques for forwarding to 18, Victoria Avenue, Harrogate—and will all our more orderly-minded members please copy!

* * * * *

LEGAL NOTES

Bull Licensing Act Offences.—At Axbridge (Somerset) Police Court, William John Brown, farmer, Mudgley Hill Farm, Wedmore, pleaded not guilty to two summonses for failing to render bulls ineffective for breeding and two summonses for exposing rejected bulls for sale.

Mr. F. Mallows prosecuted on behalf of the Ministry of Agriculture, and stated that the proceedings were taken under the Improvements to Livestock (Licensing of Bulls Act). The object of the Act was to improve livestock, and bulls kept for breeding had to be licensed.

Brown applied for six bulls to be licensed, and Mr. Wellstood White, Livestock Officer for the area, inspected the bulls and decided that none of them was fit to be licensed. Brown was aggrieved at this decision, and Mr. Butler, of Wimborne, was called in as a referee. He upheld Mr. White's decision in respect of three bulls, and allowed licences in respect of the other three. Brown, who was a man who had been dealing with cattle for a number of years, was informed that the others must be rendered unfit for breeding or slaughtered he then wrote stating that he wanted further inspection. He was advised that proceedings would be taken against him if the instructions were not carried out, and when Mr. White called upon him he said he had no intention of carrying out the order. He was allowed ten days in which to do so, but on the expiration of that time it was found that he still had two of the rejected bulls, and the other one was reputed to have been drowned. On the following day Mr. White saw the two bulls in the store cattle market at Shepton Mallet, and it was alleged that they would then have been sold as bulls fit for service. The sale of these animals was stopped, and they were subsequently sold a few days later for food.

When interviewed by the police Brown made a statement to the effect that he sent the beasts to Shepton Mallet market thinking it was the day for fat cattle, but he found that such sales had been changed from Fridays to Mondays. He received £23 for the animals, and in addition had to pay £4 4s. for the appeal, 10s. for inspections, and £1 10s. for carriage, whereas he could have sold them for £50, without any expense, if they had been licensed. In addition his heifers were barren, and he estimated that it would make a difference of £300 to him. The statement concluded by saying that the bulls were out of condition at the time of inspection owing to the hard winter and lack of feeding stuffs.

Evidence was given bearing out this statement by Mr. Mallows.

Replying to Mr. W. S. Scammell, who appeared for the defence, Brown denied that he had tried to slip the bulls through a store market, and said if he had wanted to he could have done that without going to market.

Mr. Edward Tom Tilley, Manor Farm, Loxton, vice-chairman of Somerset County N.F.U., said he was surprised that the animals were not up to standard, and Mr. Bertram Gale, veterinary surgeon, Sandford, said he could not understand why the bulls were rejected.

After a consultation in private the chairman said the Bench had decided to convict.

Mr. Mallows then stated that he was present at that Court in August, 1937, when Brown was convicted under exactly similar circumstances.

The chairman said there would be a fine of £3 in each case of failing to render bulls unfit for breeding, and £10 in each case for exposing the bulls for sale. In addition there would be an advocate's fee of £5 5s. and 5s. costs, a total of £31 10s.

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GENERAL OBITUARY

Sir Henry Head

The death was announced, on October 8th, of Sir Henry Head. Coming of an old Quaker family, he was educated at Charterhouse and in 1880 was elected to a scholarship at Trinity College, Cambridge. In due course he graduated B.A. with a first-class in physiology in the Natural Sciences Tripos. He then spent a period of two years at the German University of Prague and the University of Halle. His first paper was a contribution to *Pflügers Archiv*, in 1887 on the action current of nerve and in 1889 he published a paper on the whole question of respiratory effects of the vagus nerve. After qualifying in medicine, his M.D. thesis "On disturbance of sensation with especial reference to the pain of visceral disease" led to a long series of investigations of disorders of sensation resulting from damage to, or disease of, the nervous system, with which his work is chiefly identified. His original study of pains referred from deep structures was followed by the elucidation of the pathology of herpes zoster (shingles). His death at the age of 79 closed the career of a great neurologist.

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Prof. R. T. Hewlett

Richard Tanner Hewlett, a well-known and highly respected figure in British bacteriology for some 45 years, died on September 10th at the age of 75. Educated at King's College School and trained for his professional career at the King's College School of Medicine, Hewlett graduated M.B. Lond. in 1890 and for three years acted as demonstrator in bacteriology, eventually, in 1901, succeeding to the chair of bacteriology vacated by his chief, Prof. Edgar Crookshank. In the interval he had served (1894-1901) on the bacteriological staff of the British Institute of Preventive Medicine under its then director, Dr. Allan Macfadyen. During his career he also acted as director of pathology and later as consulting pathologist at the Seamen's Hospital, and for many years he lectured on bacteriology at the London School of Tropical Medicine.

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Prof. Hans Zinsser

The recent death in New York of Prof. Hans Zinsser, when he had nearly completed his sixty-second year, has removed an outstanding personality from the ranks of American bacteriologists. His work in the field of immunology and his researches during the past ten years into the prevention of typhus fever by means of a vaccine prepared from the causal organism had secured for him a world-wide reputation. Moreover, numerous interests, which extended far beyond the sphere of his scientific work, engaged his leisure hours, and thus he gave the impression of having lived intensely, even during the prolonged illness of which he clearly foresaw the inexorable end.

Zinsser was professor of bacteriology at Stanford University, California, from 1911 until 1913; at Columbia University, New York, from 1913 until 1923; and afterwards at Harvard Medical School, Boston. He was a member of the American Red Cross Sanitary Commission to Serbia in 1915; and in 1917 he served in the Medical Corps of the U.S. Army in France, where he acted as assistant director of the laboratories. In the summer of 1923 he visited Russia as sanitary commissioner for the Health Section of the League of Nations.

CORRESPONDENCE

Letters to the Editor should reach the Office not later than by the first post on Tuesday morning for insertion in following Saturday's issue.

The views expressed in letters addressed to the Editor represent the personal view of the writer only and must not be taken as expressing the opinion or having received the approval of the N.V.M.A.

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VICTORIA VETERINARY BENEVOLENT FUND

Appeal for Christmas Gifts

To the Editor of the Veterinary Record

Sir,—At this season for several years past you have kindly published an appeal for special donations to this Fund to enable us to give to our recipients some gift of money for Christmas so that they may be able to buy themselves a few extra comforts. The need this year is, perhaps, greater than ever before, and I hope that once again members of the profession will be willing to give generously to this special Fund.

Cheques should be sent to the Secretary of the Fund, Dr. Fred Bullock, at 18, Victoria Avenue, Harrogate, who will promptly acknowledge all gifts. Those received by December 17th will be distributed before Christmas to the widows and orphans who are on the books of the Fund.

Yours faithfully,
J. W. Brittlebank,
President.

Victoria Veterinary Benevolent Fund,
18, Victoria Avenue,
Harrogate.

December 4th, 1940.

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DISEASES OF CATTLE

To the Editor of the Veterinary Record

Sir,—I would refer Colonel Rees-Mogg to my letter in last week's *Farmers' Weekly* which reads as follows:—

"Panel Insurance" for Cattle

Sir,—I should be obliged if you would correct a misstatement which appeared in last week's *Farmers' Weekly* referring to part of my address on the "Prevention of Cattle Diseases," at Shrewsbury.

I am reported as having stated that I "had known 60 per cent. of tuberculosis cured, and over 80 per cent. of contagious abortion."

Most of your readers will know that there is no cure for tuberculosis in cattle, nor for bovine contagious abortion. My statement should have conveyed the fact that I had known a herd from which both these diseases had been eradicated, and in which, before control measures were started, 60 per cent. of the animals in the herd reacted to the tuberculin test, and 80 per cent. were shown to be infected with contagious abortion.

Eradication was accomplished by immediately removing all the reactors to both diseases to another farm in the owner's occupation, and re-stocking with young stock, reared on the farm, which had passed both the tuberculin test and the agglutination test for contagious abortion, and by purchasing animals free from both diseases.

Unfortunately, on both farms there are not two sets of buildings, at least a mile apart, to allow for segregation of infected from clean animals. But those diseases can be successfully controlled by the use of vaccines which are able to protect the animals from infection without conveying the disease to the vaccinated animals. I referred to successes which had recently been achieved along these

lines, with the vaccine produced by Dr. McEwen, of Wye Agricultural College.

K. D. Downham,
Veterinary Department,
Harper Adams Agricultural College,
Newport, Shropshire.

Yours faithfully,
K. D. Downham.

Newport,
Shropshire.
December 9th, 1940.

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STRAINED TENDONS AND THEIR TREATMENT

To the Editor of the Veterinary Record

Sir,—I have carefully read Mr. Male's letter and wish to point out an incorrect statement in his reference to Mr. Hunting's experiment. He mentions cart-horses when I particularly stated that the horses which were used for the firing test were light trotting vanners. He then says that he has found firing cart-horses not so effective as in thoroughbreds and hunters. My experience with the cart-horses is that the flexor tendons are seldom, or I might say never, strained: in the heavy horse it is the inferior carpal ligament (check ligament) which is strained and not the tendons. In this condition the animal goes on the toe and the fetlock gets stiff and difficult to flex. The flexor tendons become thickened from the shortening of the check ligament. I have found this condition the most hopeless; as Mr. Male truly says, long rest is the only treatment, but very often the animal is not worth the expense of a sufficient rest. He then goes on to say many strains are secondary to ringbone and sidebone lameness. I cannot agree about the sidebones, as I have never found them cause lameness. The late Mr. Hunting held the same opinion. About 20 years ago I attended the great Paris Horse Show, where all the heavy breeds of horses were shown. There was a championship prize given for the best heavy stallion in the show, all breeds competing, which was awarded to a magnificent big 3-year-old stallion. I examined this horse's coronets carefully and found he had well-developed sidebones. The same day I was introduced to a veterinary professor from the Paris Veterinary College (I cannot now remember his name) and mentioned about the sidebones. He replied that he had examined the stallion and the conformation of his feet, coronets and fetlocks was perfect. He then explained that sidebones were the best conformation a heavy horse could have—sidebones were a provision of nature to carry weight—and he also pointed out that the growth of sidebones was a normal deposition of bone, and was exactly the same in point of structure as the pedal bone, whereas the enlargement of a ringbone was quite different, being cancellated and porous due to its being grown as the result of inflammation. The professor also said that sidebones never caused lameness, and horses with them never got strained tendons or quittors and seldom laminitis. He then went into the cause of strained tendons and ligaments in the heavy horse, saying that this was descent of the pedal bone—this the sidebones prevented as they acted as a rivet between the hoof and the pedal bone. As to laminitis, they (the sidebones) prevented the concussion being felt so much. Since I had this conversation I have been looking for a horse with strained tendons and sidebones, but have never found one, and am inclined to believe, with the French professor, that this combination does not exist.

Mr. Male observes that on the Continent there does not appear to be any objection to firing—that, in fact, the reverse is the case. My reply to this statement is that I lived on the Continent for over six months and have attended horse markets in Belgium, Sweden, Denmark, Poland, Russia, Germany and France. I have bought a number of horses in all these countries, except Germany, where I found them too expensive for the English market. I have attended a number of horse shows, principally in France, also visited racing studs in France and Belgium, examining horses for English clients. Wherever I have been on the Continent I have never seen a horse with a fired limb: the only firing marks I have ever seen there are brand (identification) marks on the neck. For some five or six years before the present war began a large number of foreign horses were brought to London, principally from Belgium, Finland and Poland. I saw a great many of these horses but never came across one that had been fired.

The particulars of the three cases Mr. Male gives are rather vague and not easy to follow. (No. 1) Mr. Male says the horse had prolonged treatment and rest over two seasons. He does not mention complete continuous rest, which the horse got after being fired. Had the animal been rested the same length of time without being fired, he would have done better. The firing gave enforced rest. (No. 2) Was treated for 12 months; this case evidently had no long continuous rest until fired. Enforced rest again. (No. 3) The tendons were line-fired and suspensory point-fired. A few weeks later he was gradually brought in to work. I cannot imagine a horse being put to work a few weeks after being line- and point-fired.

I recently met a canine practitioner who does a large practice among dogs, including greyhounds, used for track racing. The subject of firing was discussed and I was told that for a time the firing iron was used on the limbs of track racing greyhounds which had gone wrong—it was found to be a failure. I have also been told by a veterinary surgeon that the use of the firing iron was not taught, and any firing in this College was done by one of the College grooms.

Before I had seen Mr. Male's article in the *Record* I met him at a horse sale and we had a very friendly conversation about firing. Mr. Male talked about his belief in firing with much fervour and stated that he had fired thousands of horses. I have found the treatment of strained tendons without firing very successful.

I have read Mr. Catmur's letter on strained tendons and thoroughly agree with what he has said. He describes firing as mutilation—which, to my mind, is its correct name.

Yours faithfully,
R. C. Irving.

Shenley Lodge,
Nr. Barnet,
Herts.

* * *

To the Editor of the Veterinary Record

Sir,—I must apologise for again entering the lists, but Mr. Catmur's letter in your last issue throws another sidelight on the discussion on the treatment of strained tendons. Whereas Mr. Irving wanted proof as to the efficacy of firing which I endeavored to supply, Major Hancock attacked it on ethical grounds. I pointed out that if the operation was carried out skilfully with adequate anaesthetics and proper after-treatment the pain and distress could be reduced to a minimum; in fact it can be claimed that the pain would be no more and often less than that following a great many operations carried out daily, *e.g.*, castration. One might argue that castration should never be performed, but in both cases animals are made more serviceable. Mr. Catmur, on the other hand, is perturbed that perhaps firing cannot be supported on scientific grounds. It is true that the exact changes that take place in the tissues have not been described in veterinary literature, but if we refrained from employing anything that had not been fully elucidated scientifically we should find ourselves seriously limited in our treatment, and in the drugs and operative measures we now use with success. For example, the curative effects of inflation of the udder for milk fever had not been explained scientifically when being used to save the lives of thousands of animals. Practice often marches ahead of

science. Lister could not explain at first why aseptic or antiseptic surgery was successful; the scientific reasons followed later. A great many of our most useful drugs were in general use centuries before it was known exactly how the results were obtained. Cinchona bark was used by the South American savages hundreds of years before quinine was isolated from it and longer still before the malarial parasite was discovered, and even to-day we do not know its exact action. Again, the beneficial effects of cod-liver oil were noted long before vitamins were discovered. In this connection I would recommend the perusal of a most delightful lecture on "How do Drugs Act?" by Sir Walter Langdon-Brown, which I enclose.* This reveals the enormous strides in our knowledge that have been made in the last few years, showing that we have all been empirics. The old observers were not all fools and I have been amazed when reading old veterinary and medical literature at the accuracy and shrewdness of their deductions which shame many of our present-day clinicians although they have the advantage of all the modern aids to diagnosis. They were certainly not wrong when they claimed that the actual cautery was a most effective treatment for strained tendons.

I do not think it is very difficult to visualise the changes that take place in a fired leg. Tendons have a low degree of vascularity; if, therefore, we observe the reparative processes that take place as the result of an injury to the cornea—which is non-vascular—it may assist the solution of the problem. There is hyperaemia, leucocytosis, exudation, penetration by capillary blood vessels, granulation and cicatrisation, and the continuity of the cornea is repaired often with the help of stimulation. In sprains a similar healing process takes place, but unfortunately when there has been a rupture of the fibres of the tendon, the new tissue is not strong enough to resist the calls made upon it by severe work and excessive speed. Consequently, the ordinary repair processes have to be augmented, a more severe inflammation being aroused by applying the actual cautery to the deeper layers of the skin—and in the case of the suspensory ligament and sometimes the tendons to these deeper structures, by means of the point iron. More and stronger fibrous tissue is formed in the tendons and aponeurosis, adhesions take place, the dermis becomes denser and less elastic and, owing to the contraction of the cicatricial tissue, there is a bracing and strengthening of the whole of the parts. This is borne out by my observations on both living and dead legs that I have examined. It is not exactly a question in thoroughbreds and hunters of rest *v.* firing. Rest and appropriate treatment may be sufficient to restore usefulness in some horses, but if this fails, and in severe cases, resort must be made—until something better is discovered—to the actual cautery. Even this will not work a miracle, some legs being beyond repair, though I have been astounded at times by its results when even I had lost hope.

Mention has been made of the views of Professor Macqueen. I was his House Surgeon in 1903 and commenced my firing career under his able tuition and with his encouragement. There is no doubt that he was a firm believer in its efficacy.

Yours faithfully,
G. P. Male.

Westcroft,
Earley,
Reading.

*An extended abstract of this lecture will appear in an early issue.—*Editor.*

* * * * *

To the Editor of the Veterinary Record

Sir,—Having practised in pre-motor days, when at the end of the various seasons we were kept busy firing and blistering for curative or preventive reasons in respect of tendons, joints and ligaments, the correspondence with regard to the efficacy of the actual cautery in the treatment of strained tendons has been most interesting to me.

Years ago I formed the opinion that firing was barbarous, and in the majority of cases of little, if any, use, but I must support Mr. Male in that when applied to racehorses it appeared to succeed when all other treatment had failed.

In the old days I had no doubt of the cruelty caused by the use of heavy, cumbersome irons applied too heavily and too slowly. The operation could be practically painless without nerve blocking, or resorting to the twitch and holding up a leg, by using small light irons at a red heat, applied quickly and lightly.

The following treatment has proved quite satisfactory. One, or perhaps two, applications of a "Green Blister." When the action has completely ceased and the parts are cool, cold water irrigation followed by linen bandages soaked with a solution of pot. nit. and ammon. mur. is carried out until the tendons are hard and cool. Up to that time the patient is kept in a loose box with plenty of bedding to induce rest. Then comes a period of gradually increased walking exercise until the *muscles* of the limbs are hard and fit enough to permit a gradual increase in the pace with safety. In my opinion the great faults are: (*a*) turning the patient out to grass or into a paddock after either firing or blistering; (*b*) improper and excessive exercise before the muscles are fit enough to cope with it.

It seems to me that the "pros" and "cons" of firing have been well set forth, and it would be to our advantage to hear the results of treatments, other than firing or blistering, that have been put to the test.

I am, Sir,
Faithfully yours,
R. F. Wall.

The Willows Bungalow,
Maidenhead Road,
Windsor.

December 3rd, 1940.

* * * * *

To the Editor of the Veterinary Record

Sir,—There is one question I would like to put to those who oppose the use of the firing iron. If they were in attendance on a racehorse which was badly broken down (*e.g.*, severe strain of the perforatus and perforans tendons of one foreleg), and the owner wished to run the horse over the Grand National course in twelve months time, what would they recommend as the treatment most likely to enable the animal to be trained for this purpose?

If this question elicits any replies, I hope you, Mr. Editor, will accept one more letter from me in which I may be critical in my turn.

Yours faithfully,
A. C. Fraser.

Veterinary Establishment,
Lambourn, Berks.

December 3rd, 1940.

* * * * *

VETERINARY BIOLOGICAL PRODUCTS,
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To the Editor of the Veterinary Record

Sir,—As legislation for standardisation and potency, so far as the above are concerned, is lacking, and pending that legislation, Messrs. Rowlands and Harbour's communication would have been most valuable if the manufacturers of the sera (?) "found wanting" had been named; alternatively, if the names of the manufacturers whose product was potent, or sufficiently potent, had been given—so as to protect the practitioner, the client and, not least, the patient.

Yours faithfully,
J. W. Hall Masheter.

Newnham-on-Severn.

December 9th, 1940.

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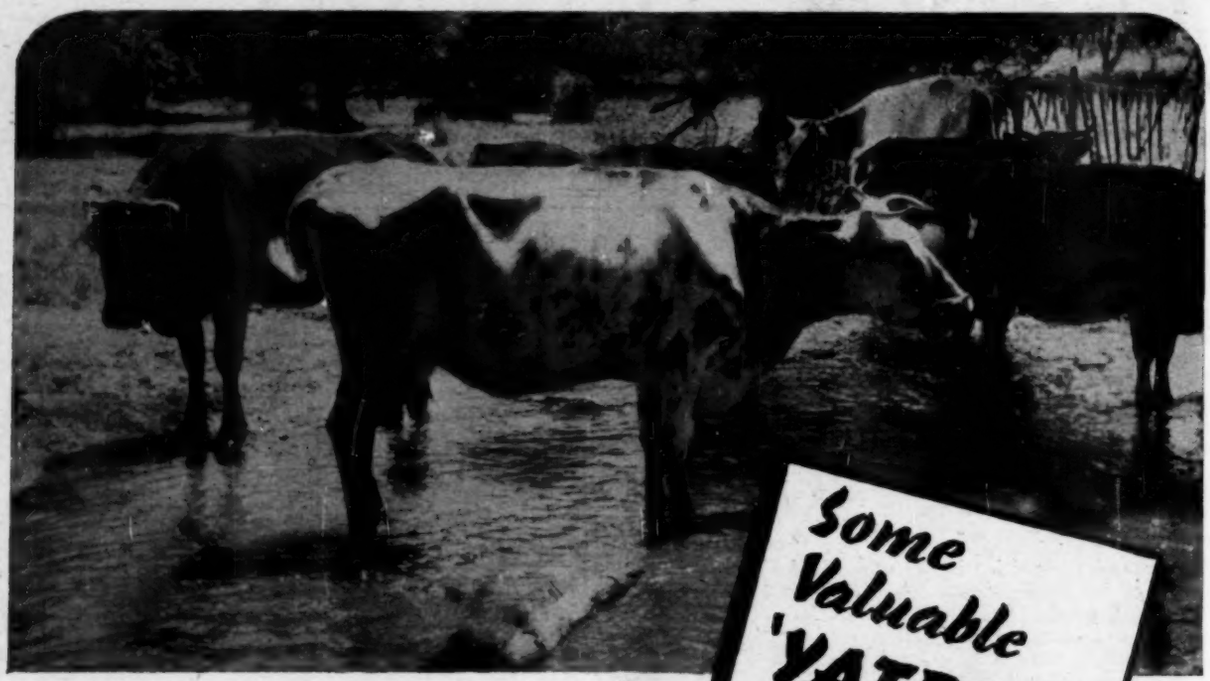

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